anticipation

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No. 8 September, 1971

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THE FUTURE OF THE GLOBAL ENVIRONMENT

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These papers are circulated for the information of participants in the ecumenical enquiry on "The Future of Man and Society in a World of Science-Based Technology". Comments are welcome.

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EDITORIAL NOTE

Three different perspectives on the dilemmas of "the future" collided when the Church and Society Working Committee - plus about thirty consultants from various regions and disciplines - met at Nemi, Italy, in June 1971. This encounter between the technological, socio-political and counter-cultural revolutions of our time took place in the context of a further elaboration of the Church and Society study programme on "The Future of Man and Society in a World of Science-Based Technology".

In addition, the Committee outlined a new two-year project on "Violence, Nonviolence and the Struggle for Social Justice - Exploring Strategies for Radical Social Change".

The reports of the meeting will appear in the forthcoming issue of the WCC journal Study Encounter and an off-print of the three which deal with "The Future of Man ... " theme is enclosed. In addition, we are devoting this and the next two issues of Anticipation to reproducing papers presented at Nemi as well as some of the responses these evoked.

In this issue ...

Jørgen Randers, a Norwegian physicist presently working with the Massachusetts Institute of Technology, offers a very sobering evaluation of current trends in rising populations, growing environmental pollution and intensifying world demand for limited natural resources. Responses to his thesis come from Denys Munby (Reader in Transportation Economics at Nuffield College, Oxford), C.T. Kurien (Head of the Department of Economics at Madras Christian College), Charles Elliott (Assistant Secretary of SODEPAX, the WCC/Vatican Joint Committee on Society, Development and Peace) and S. L. Parmar (Professor of Economics at the University of Allahabad and Chairman of the Church and Society Working Committee).

The future, clearly, will be an urban future for rapidly increasing numbers of people and nowhere is this more obvious than in Latin America. Jorge Hardoy, who looks at the issues involved in "Urbanisation and the Human Environment", is Director of the Centre for Urban and Regional Studies in Buenos Aires.

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NB. Some of the above material was transcribed from recorded tapes. Such errors as may have found their way into the text should be attributed to the editorial fallibility of staff.

I

THE CARRYING CAPACITY OF OUR GLOBAL ENVIRONMENT - A LOOK AT THE ETHICAL ALTERNATIVES*)

by

Jørgen Randers

> For which of you, intending to build a tower, sitteth not down first, and counteth the cost, whether he have sufficient to finish it?
>
> Luke 14:28

The main thesis of my talk is very simple: because our environment - the earth - is finite, physical growth cannot continue indefinitely. In spite of its simplicity, the consequences of this fact pose an unprecedented challenge to mankind. The challenge lies in deciding on the ethical basis for making the trade-offs which will confront us in the near future - trade-offs which arise because our globe is finite.

The Environment is Finite

It should be quite unnecessary to point out that our environment is finite. However, most considerations of our future options lose sight of this fact. Thus, it will be worthwhile to spend some time discussing the physical limitations of the earth - especially because it is not generally recognized that we are already quite close to several of the physical limitations which define the carrying capacity of our globe.

Agricultural Land

The quantity which most obviously is in finite, completely inelastic supply on our earth is land. There is about 3.2 billion hectares of land suitable for agriculture on the earth. Approximately half of that land is under cultivation today. The remaining half will require immense capital costs to settle, clear, irrigate, or fertilize before it can produce food. The costs will be so high that the United Nations' F.A.O., which is seeking desperately to stimulate greater food production, has decided that in order to expand food output it must rely on more intensive use of currently

*) Paper presented to the Working Committee on Church and Society, World Council of Churches, Nemi, Italy, June 20-26, 1971.

cultivated land, not on new land development.

If we do decide to incur the costs and to cultivate all possible arable land and to produce as much food as possible, how many people could we expect to feed? The lower curve in Figure 1 shows the amount of land needed to feed the growing world population, assuming that the present average of 0.4 hectares per person is sufficient. (If we wanted to feed all of our 3.6 billion people at U.S.A. standards, we would require 0.9 hectares per person.) The actual growth in population from 1650 to 1970 is depicted with a heavy line; the projected growth at 2.1% per year after 1970 by a lighter line. The upper curve indicates the actual amount of arable land available. This line slopes downward because each additional person requires a certain amount of land (0.08 hectares assumed here) for housing, roads, waste disposal, power lines, and other uses which essentially "pave" land and make it unusable for farming.

The graph in Figure 1 tells us that, even with the optimistic assumption that we will utilize all possible land, we will still face a desperate land shortage before the year 2,000.

The graph also illustrates some very important facts about exponential growth within a limited space. First, it shows how one can move within a few years from a situation of great abundance to one of great scarcity. The human race has had an overwhelming excess of arable land for all of our history, and now within 40 years, or one population doubling time, we will be forced to learn to deal with a sudden and serious shortage.

A second lesson to be learned from Figure 1 is that the exact numerical assumptions we make about the limits of the earth are essentially unimportant when we are faced with the inexorable progress of exponential growth. For example, we might assume that no arable land is taken for cities, roads, or other non-agricultural uses. In that case, the land available is constant, as shown by the horizontal dashed line, and the point at which the two curves cross is delayed by only about 10 years. Or we can suppose that we will double, or even quadruple the productivity of the land, through advances in agricultural technology. The effect of increasing productivity is shown by the dotted line in Figure 1. Each doubling of productivity gains us just one population doubling time, or about 30 years.

Some people look to the sea to provide the extra requirements. But the total world fish catch in 1969 represented only a few percent of the world's protein, and the total catch in 1970 decreased from 1969. That was the first decrease since World War II. Most experts agree that the world's fish banks have been overfished and that prospects are for further decline, not advances, in protein output. The seas thus can not eliminate the constraints imposed on growth by limited land.

Heat Release

We are faced with further obvious constraints in connection with natural resources like fresh water, metals, and fuels. Indications are that several of these will be in short supply even at higher prices within the next forty years, if present growth continues. However, it is argued that mining

low grade ores and desalting the sea's water can alleviate these problems, and it may indeed be so, assuming that we can satisfy the concurrent enormous demands for energy.

A consideration of the energy that will be necessary to meet man's growing needs leads us to a more subtle and much more fundamental physical limitation imposed by our environment. Even if we assume that we find the means to generate the energy needed - for instance, controlled fusion - we are still faced with the fundamental thermodynamic fact that all energy generated finally ends up as heat. This is so, irrespective of whether the energy was generated by burning of coal or oil, or by nuclear reactions - and irrespective of what the energy is being used for. It is theoretically impossible to avoid this release if we want to consume energy.

The crucial point is that this heat will begin to have worldwide climatic effects when the released amount reaches some appreciable fraction of the energy normally absorbed from the sun. Thus, if we want to avoid major changes in the climate there is a fundamental limit to the amount of energy we can consume on the earth.

It may be of interest to you to know that if the energy consumption increases at 4% per year for another 130 years, we will at that point in time be releasing heat amounting to 1% of the incurring solar radiation - enough to increase the temperature of the atmosphere by $3/4^{\circ}$ C. That may sound like an unimpressive figure, but on a worldwide basis it could amount to climatic upheavals like increased melting of the polar caps. Local perturbations may come much sooner. In just 30 years the American megalopolis from Boston to Washington will be releasing through its energy consumption up to 50% of the normal incident solar energy of that area.

Pollution Absorption

The third limitation I would like to mention is our globe's finite absorptive capacity for pollution. Until quite recently our environment was considered infinite. It seemed incredible that the use of soap for one's laundry and pesticides for one's roses should possibly be able to affect the workings of the world ecosystem. But after the death of Lake Erie, the global increase in atmospheric CO_2, and the prohibition in the U.S. of swordfish due to its content of mercury, it is abundantly clear that our environment is only able to absorb and degrade a limited amount of emissions and waste every year. When we exceed this absorptive capacity, we not only cause pollutants to accumulate in nature, but we also run the risk of completely destroying the natural degradation processes themselves, and thus decreasing the future absorptive capacity.

Thus we realize that absorptive capacity - far from being a good in unlimited supply - is an extremely valuable, scarce resource, which in fact limits the total possible emissions from human activity.

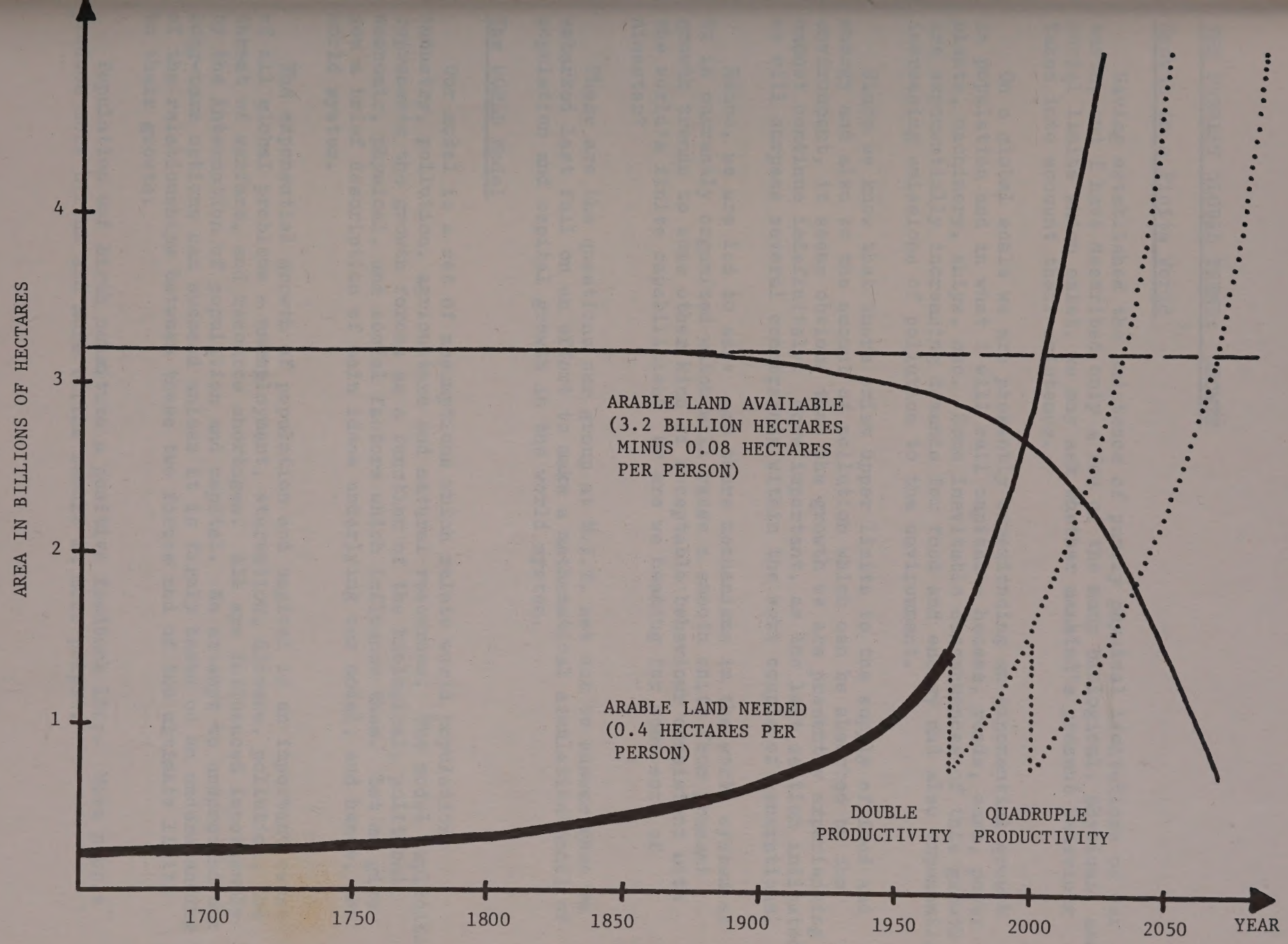
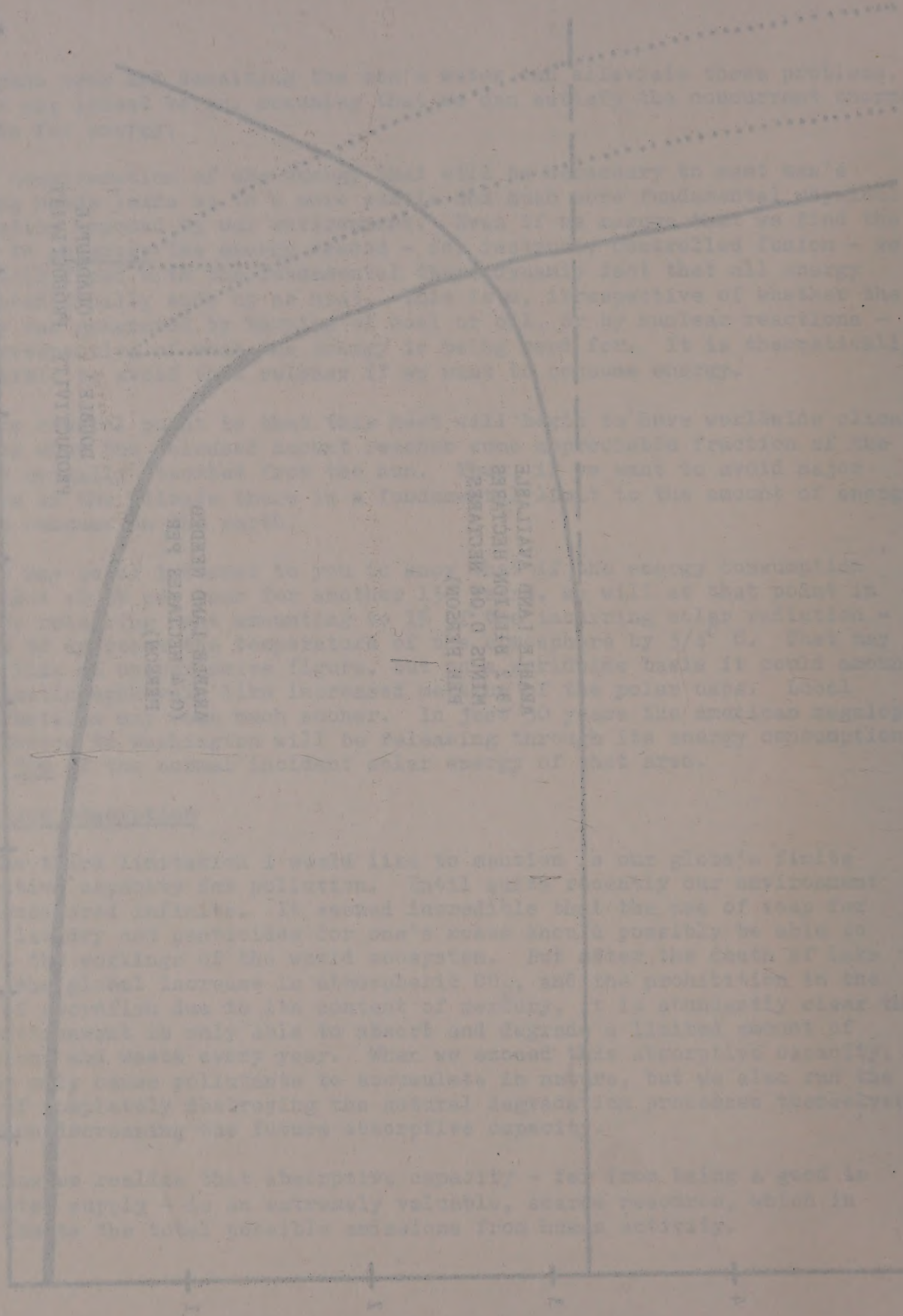


FIGURE 1: Available and needed land area.


ATOMS IN FAMILIES (NO. PER SQ. MILE)
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
8000
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THE PRESENT GLOBAL TREND: GROWTH

Growth in a Finite World

Having established the existence of purely physical limitations of our earth, and I have described only a few of the many biological, physical, and social limits which exist, we may ask whether mankind's present behaviour takes into account their existence.

On a global scale we are presently experiencing an exponential growth in population and in what I will call capital - houses, roads, cars, power plants, machinery, ships, etc. Some inevitable consequences of this growth are exponentially increasing demands for food and energy and also exponentially increasing emissions of pollution to the environment.

Since we know that there exist upper limits to the supply of food and energy and also to the amount of pollution which can be absorbed by the environment, it seems obvious that the growth we are presently experiencing cannot continue indefinitely. More important, as the last section indicated, we will surpass several constraints within the next couple of generations.

Hence, we are led to ask: are there mechanisms in the world system as it is currently organized which will cause a smooth shift from present growth trends to some other kind of acceptable behaviour consistent with the world's finite capabilities? Or are we heading for some sort of disaster?

These are the questions our group at M.I.T. set out to answer when we embarked last fall on an effort to make a mathematical simulation model of population and capital growth in the world system.

The WORLD Model

Our model is a set of assumptions which relate world population, industry, pollution, agriculture and natural resources. The model explicitly represents the growth forces as a function of the biological, political, economic, physical, and social factors which influence them. Let me give you a brief description of main ideas underlying our model, and hence, the world system.

The exponential growth of population and capital is an important cause of all global problems - unemployment, starvation, disease, pollution, the threat of warfare, and resource shortages. All are influenced importantly by the interaction of population and capital. No attempt to understand our long-term options can succeed unless it is firmly based on an understanding of the relationships between these two forces and of the ultimate limits to their growth.

Population and birth constitute a positive feedback loop. More people produce more births and more births result in more people.

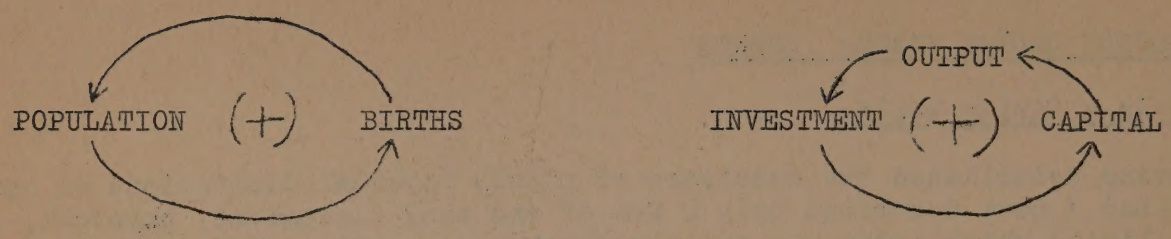


FIGURE 2: The positive feedback loops governing the growth in population and capital.

Wherever there is a dominant positive feedback loop of this form, exponential growth will be observed. Capital produces industrial output. Greater output, all else equal, results in a larger investment and thus in more capital. Thus capital and investment constitute another positive feedback loop. The interactions among population and capital determine the rate at which each of them grows. The interaction takes many forms (Figure 3).

As a greater fraction of output is diverted from investment, the growth rate of capital decreases. Output may be diverted to consumption and services, to agriculture, and to military expenditures. As consumption and services increase, health and education improve, average lifetime becomes greater, deaths decrease, and population grows. Similarly, output may be diverted into agricultural capital which results ultimately in more food and a higher average lifetime. The primary determinant of the fraction of output reinvested is the output per capita. Where production per capita is low, most of the output must be diverted to consumption, services, and food. Those allocations reduce the rate of accumulation of the capital base and, at the same time, stimulate the growth of population. Population can increase much easier than capital in traditional societies. Hence, output per capita remains low in these countries and they find it very difficult to achieve economic growth.

Output diverted into military expenditures subtracts capital from the system and does not generate future growth directly. Industrial output also leads to the depletion of natural resources. As natural resources decline, the efficiency of capital decreases and the output-capital ratio goes down.

Output per capita is the single positive force acting to slow the population explosion. As output per capita increases, the desired family size declines, the birth rate goes down, and population growth typically decreases. The influence of this is accelerated somewhat by the fact that as death rates decline there is a further decrease in desired family size. A large portion of the world's parents bear children primarily as a source of support in their old age. If there is a high mortality rate, one must bear three or four sons to insure that one will live. Thus, as the perceived death rate decreases, birth rates also decline. Output has one additional impact. Output leads to the generation of pollution. Pollution decreases food, and also decreases the average lifetime.

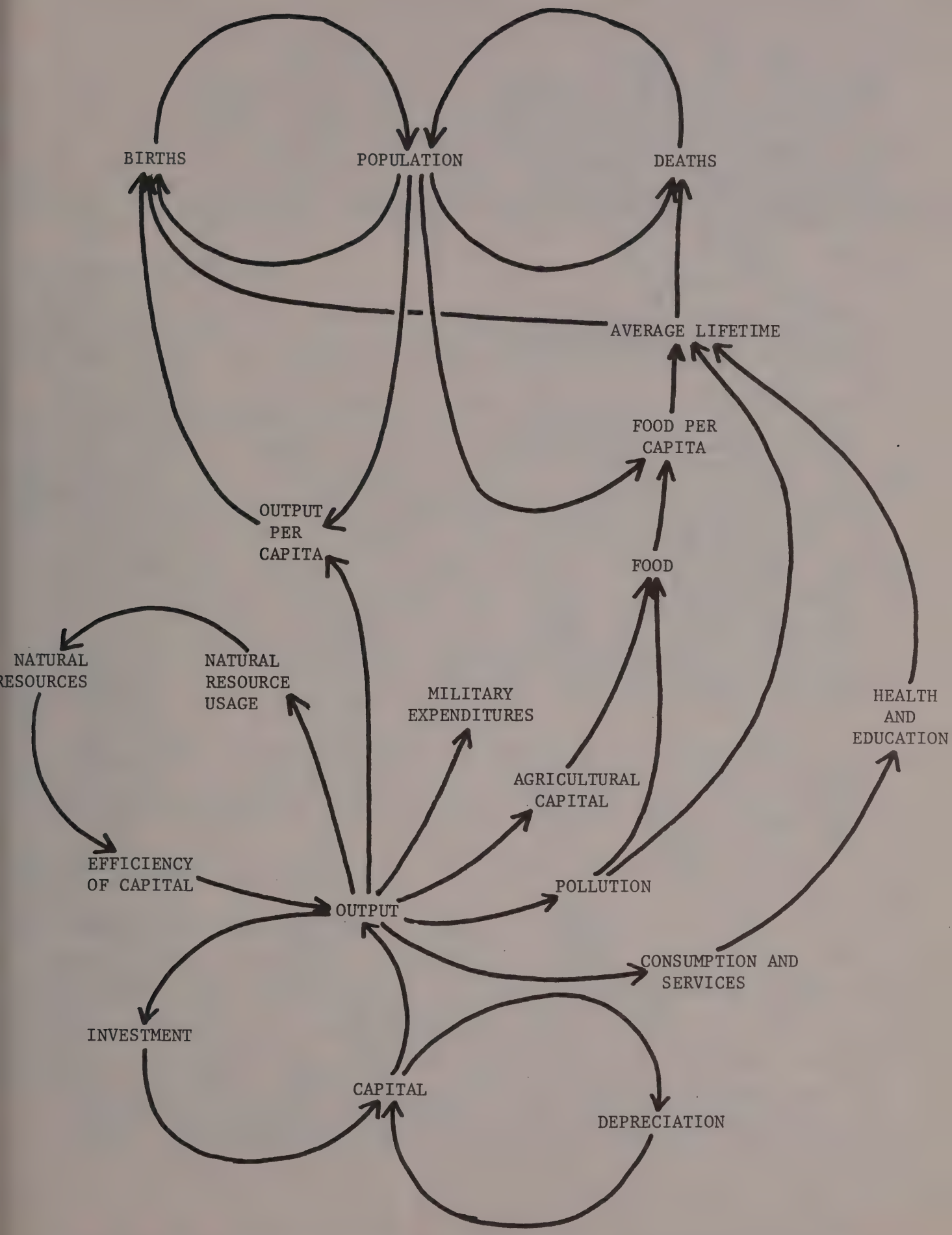
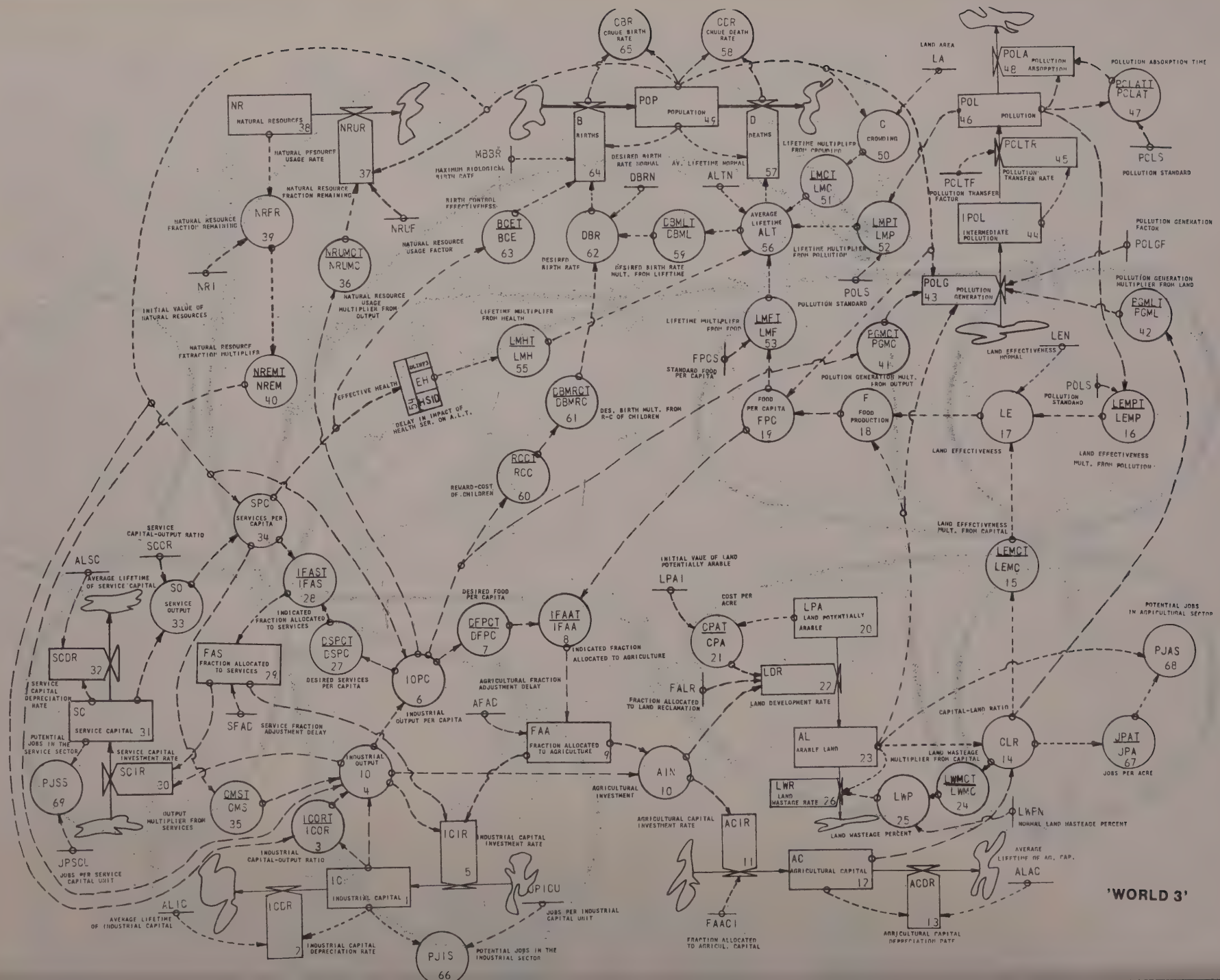


FIGURE 3: Basic Interactions Between Population Growth and Capital Accumulation


CBR CRUDE BIRTH RATE 65
CDR CRUDE DEATH RATE 58
POP POPULATION 45
B BIRTHS 64
D DEATHS 57
C CROWDING 50
NR NATURAL RESOURCES 38
NRUR 37
NRFR 39
NRI
NRUMCT NRUMC 36
NREMT NREM 40
BCET BCE 63
DBR 62
CBMLT CBML 59
AVERAGE LIFETIME ALT 56
LMCT LMC 51
LMPT LMP 52
LMHT LMH 55
LMFT LMF 53
CBMRCT DBMRC 61
RCCT RCC 60
EH
DELAY
LS
SID
FPC FOOD PER CAPITA 19
F FOOD PRODUCTION 18
LE 17
LEMPT LEMP 16
LEMCT LEMC 15
PGMCT PGMC 41
PGMLT PGML 42
POLG POLLUTION GENERATION 43
IPOL INTERMEDIATE POLLUTION 44
PCLTR 45
POL 46 POLLUTION
POLA 48 POLLUTION ABSORPTION
PCLAT PCLAT 47
PCLS
POLS
POLCF
LA
LEN
MBBR
DBRN
ALTN
PCLTF
SPC SERVICES PER CAPITA 34
SCCR
ALSC
SO SERVICE OUTPUT 33
IFAST IFAS 28
FAS FRACTION ALLOCATED TO SERVICES 29
CSPCT CSPC 27
SCDR 32
SC SERVICE CAPITAL 31
SCIR 30
PJSS 69
JPSCL
SFAC
CMSI CMS 35
ICORT ICOR 3
ICCR 2
IC INDUSTRIAL CAPITAL 1
ICIR 5
JPICU
ALIC
PJIS 66
IOPC 6
DFPCT DFPC 7
IFAAT IFAA 8
FAA FRACTION ALLOCATED TO AGRICULTURE 9
AFAC
AIN 10
IOUT INDUSTRIAL OUTPUT 10 4
LPAI
CPAT CPA 21
LPA LAND POTENTIALLY ARABLE 20
LDR 22
FALR
AL ARABLE LAND 23
LWR LAND WASTAGE RATE 26
LWP 25
LWMCT LWMC 24
CLR 14
JPAT JPA 67
PJAS 68
LWFN
ACIR 11
AC AGRICULTURAL CAPITAL 12
ACDR 13
FAACI
ALAC
'WORLD 3'

Most global problems have important roots in this simple set of interactions (1). Formalizing these interactions into a simulation model (Figure 4) is useful because it makes it possible to study the future implications of the world system's present organization. The model further permits analysis of the policy alternatives for natural resources, birth control, food production, economic development, etc. which we must now begin to evaluate. (See Figures 5, 6, 7.)

The Inevitable Collapse

Simulation runs like these, have led us to conclude that there are no mechanisms currently existent that will bring the present growth to a smooth stop when we reach the maximum level consistent with our finite environment.

Of course this does not mean that growth will not stop. It only means that, instead of an orderly transition to some feasible state, we will overshoot the physical limitations and then be forced into a traumatic decline back down to some level of population and industrialization which can be supported by our physical environment - which by then will be sorely depleted. For once we exceed a constraint, tremendous pressures will develop to halt the growth. If it so happens that we begin by exceeding the absorptive capacity for pollution, the pressures will take the form of radical increases in death rates due to impurities in food, water and air, decreases in crops and fish catches due to similar reductions in plant and animal life, and significant reduction in the effectiveness of investment due to high costs of controlling the high pollution in all input-factors. These pressures will mount until the population and industrialization finally involuntarily start to decline, and the pressures will only cease when levels are reached which are acceptable to the physical environment.

If we attempt to continue growth by removing one set of pressures - for instance, by introducing complete pollution control - we alleviate the situation only until we encounter the next constraint. And so on. Because the environment is finite, physical growth will always bring us into conflict.

THE ETHICAL BASIS FOR ACTION

The Short-Term Objective Function

Thus we are faced with the fact that continuation of current growth practices will inevitably lead us to some sort of collapse, with a subsequent decrease in the cultural and economic options of the human race. The natural question to ask is: what can we do?

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(1) Further information about our modeling effort can be obtained from System Dynamics Program Office, A.P. Sloan School of Management, E40214, Massachusetts Institute of Technology, Cambridge, Mass. 02139, U.S.A.

It is important to realize that our answer to this question is completely dependent on our choice of criteria for what is "good". If we do not know what we want to obtain, if we don't know our "objective function", it is meaningless to try to decide what to do in a given situation. If our objective is to maximize the benefits of the people alive today, our course of action will be quite different from our actions if the goal is to maximize the benefits of all people who are going to live on our planet over the next 200 years.

At least in principle present human behaviour is guided by the general idea that all people alive today are equally important and that the objective function is to maximize the total current benefits for all of these people. We have decided, at least in the Western democracies, that this objective is best served by letting each individual be free to pursue his own interest. It is assumed, very simply that if every citizen and institution in our societ acts to maximize his own position in the short term, the society as a whole will benefit.

This acceptance of "The Invisible Hand" has, however, introduced a strong emphasis on short-term benefits in our societies. When an action will bring both benefits and costs over time, individuals use the concept of net present value and discount the future implications so that they can determine whether an action should be taken now or ten years from now or never. The result of this procedure is that we assign essentially zero value to anything happening more than twenty years from now.

If we choose to adhere strictly to the objective of maximizing the short-term rewards of the present generation, there are in fact no environmental trade-offs to be made where we will have to weigh current benefits against future costs. In this case we would simply continue as before, maximizing the current benefits and neglecting any future costs which will result.

The question about use or non-use of DDT, for example, would be easily resolved. The fact that 1.3 billion people today can live in safety from malaria due to DDT would grossly outweigh the costs inflicted upon future generations through our continued use of the chemical.

It is only this short-term objective function which can lead to the currently accepted conclusion that the value of an additional human being is infinite. The severe restrictions his existence will impose on the choices and perhaps even the lives of future generations - because of his consumption of non-renewable natural resources - is completely neglected.

Thus we see that adherence to the short-term objective function resolves very simply all trade-offs between current benefits and future cost. Of course we will be left with the ordinary trade-offs among people alive today - for instance, the choice between denying the firm upstream freedom to dump waste in the river and denying those who live downstream pure drinking water. But these short-term conflicts are not relevant to our discussion, because we do have mechanisms in our society to resolve conflicts between two people alive today.

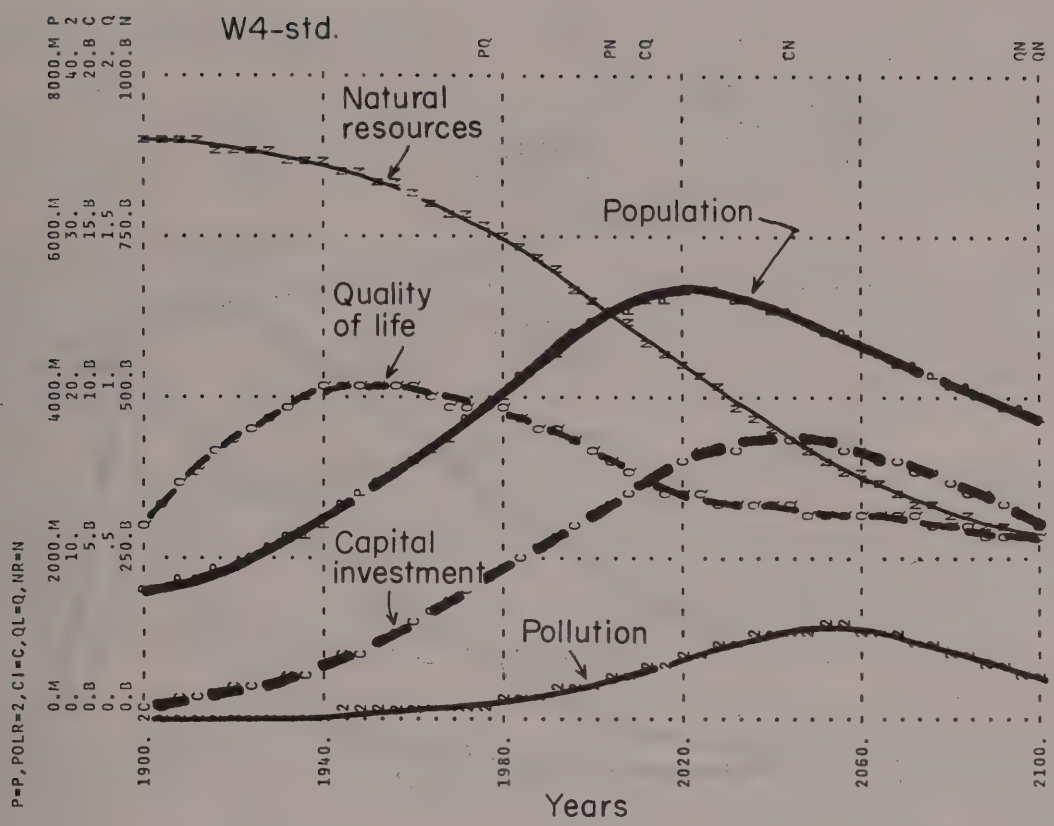

FIGURE 5: Basic world model behavior showing the mode in which industrialization and population are suppressed by falling natural resources.

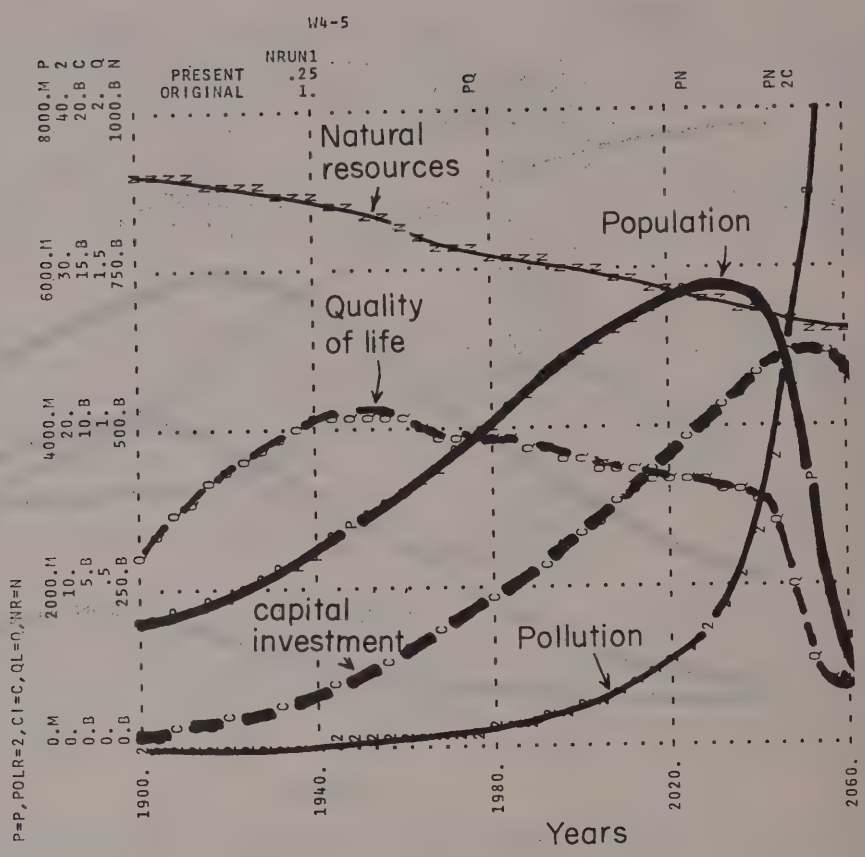

FIGURE 6: Pollution crisis precipitated by a successful attempt at lowering the usage rate of natural resources.

In 1971 natural resource usage is reduced 75 percent by more effective technology without affecting material standard of living.

We do not have, however, mechanisms, or even moral guidelines, for resolving conflicts between the current population and the people of the future. And at the same time our simulation model demonstrates that the present preoccupation with what seems pleasant or profitable in the short-run fuels the growth which is finally going to make the world overshoot some physical constraint, forcing us into a period of abrupt and significant changes.

The Long-Term Objective Function

It is, however, possible to change the objective function - in the same way as Christianity changed the objective of man from selfish gratification to consideration for the welfare of all other people living at the same point in time.

Today we could change again, and for example adopt as our cardinal philosophy the rule that no man or institution in our society may take any action which decreases the economic and social options of those who will live on the planet 100 years from now. Probably only religion has the moral force to bring such a change.

We are basically facing only one ethical question in the impending global crisis. This is to decide on whether we want to continue to let our actions be guided by the short-term objective function, or whether we should adopt a longer-term perspective. In other words: the ethical question confronting global society today is to decide on the length of the time period used when comparing the costs and benefits of current actions.

Some of you might think that we should stay with the goal of maximizing the benefit of the present population, simply because we are still so very far from having attained this goal, as evidenced by the unequitable distribution of the world's wealth between the industrialized and the developing countries. However, before making this choice, one should remember our conclusion from the last section, indicating that a continued reliance on short-term objectives only makes it certain that there will be no acceptable future - for any country.

It is my feeling that the Church should adopt the goal of increasing the time-horizon implicit in mankind's activities - that is, introducing the longer-term objective function which maximizes the benefit of those living today, subject to the constraints that it does not decrease the economic and social options of those who will inherit this globe, our children and grand-children.

This goal is of course not completely foreign to contemporary society. It seems to be the value implicit in the actions of conservationists. However, ultimately it must be present in all of our activities.

EQUILIBRIUM - A DESIRABLE POSSIBILITY

A Lasting Solution

Assuming that we accept the long-term objective function as the guideline for our actions, what will we do about the approaching collision between our growing societies and the physical limits of the earth?

As soon as we are committed to the creation of a long-term, viable world system our most important task becomes to avoid the trauma connected with actually exceeding any environmental limitation. We must deliberately stop physical growth. We must engineer a smooth transition to a non-growth situation - an equilibrium, a steady state - which is in accordance with environmental limits. We must ourselves develop and employ legal, economic or religious pressures as substitutes for those pressures which would otherwise have been exerted by nature to halt physical growth.

By starting now we may still be able to choose the set of pressures we prefer to employ in stopping population and capital growth. We cannot avoid pressures. Counter forces will rise until growth stops. However, a deliberate choice is likely to leave intact many more of our fundamental, long-term objectives than is the blind and random action of natural forces such as starvation, social breakdown, etc.

The steady state is first of all defined by constant population and capital (see Figure 8). The second requirement is equally important. Since we want to create a system capable of existing for a long time, the state of equilibrium must be characterized by minimal consumption of non-renewable materials and by minimal emissions of non-degradable waste.

In this equilibrium mode of human civilization, science and technology will be busily developing ways of constructing products which last very long, do not omit pollution, and can be easily recycled. Competition among individual firms will continue, but the total market for material goods will no longer expand.

Although equilibrium implies non-growth of all physical activities, this will not be the case for cultural activities. Freed from the preoccupation with material goods, people will throw their energy into development of the arts and sciences, into the enjoyment of unspoiled nature, and into meaningful interactions with their fellow man.

The Golden Age

Only an orderly transfer into an equilibrium state will save us from the tumult of an environmental crisis, and again put the human race into harmony with the world's ecosystem.

The presence of equilibrium could permit the development of an unprecedented golden age for humanity. Freedom from ever-increasing numbers of people will make it possible to put substantial effort into the self-realization and development of the individual. Instead of struggling merely

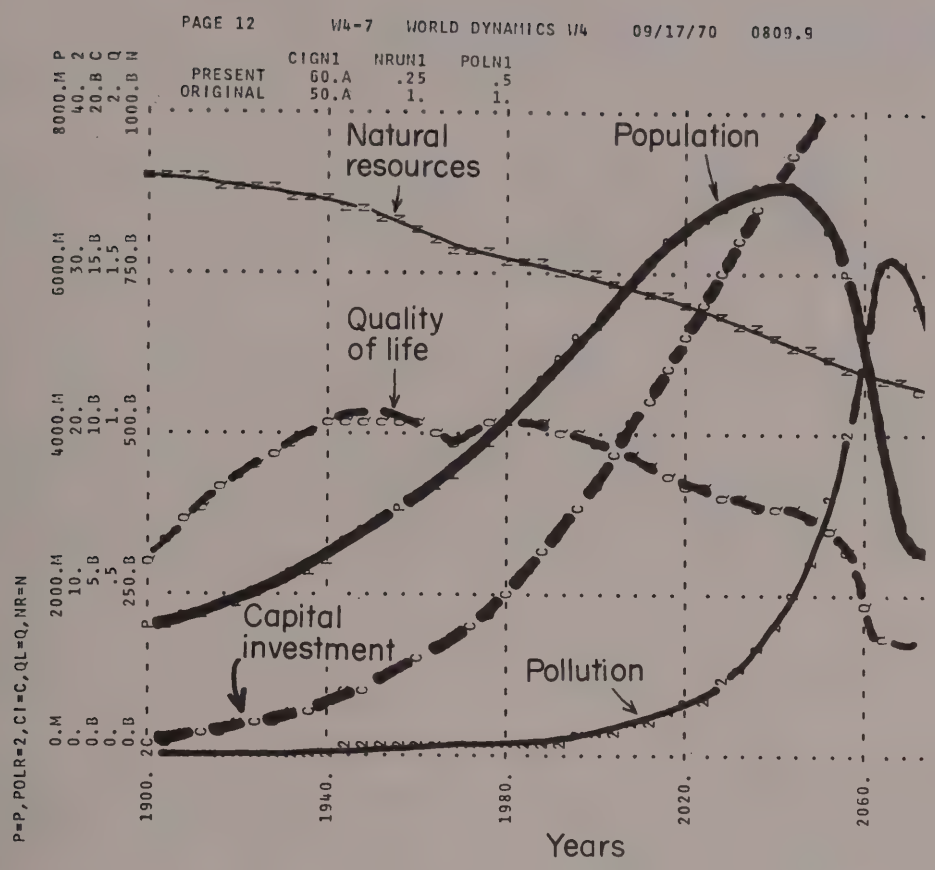

FIGURE 7: The capital investment rate is increased in order to reserve the beginning decline in quality of life and the reduced natural resource usage from Figure 6 are retained. In addition in 1971 the normal rate of pollution generation is reduced 50 percent. The effect of pollution control is to allow population to grow 25 percent further and to delay the the pollution crisis by 20 years.

to keep people alive, we could employ our energy in developing the human culture - that is, in increasing the quality of life for the individual to a level high above the present subsistence. The few periods of equilibrium in the past - for example, the 300 years of Japan's classical period - often witnessed such profound flowering of the arts.

The freedom from ever-increasing capital - i.e. from more concrete, cars, dams and skyscrapers - would make it possible even for our great-grandchildren to enjoy solitude and silence.

But more importantly, equilibrium would ultimately lead to an equitable distribution of the wealth throughout the world - because one would no longer be able to accept inequalities in the present under the pretence that they would be removed through future growth. Or in the words of H.E. Daly (2), the American economist:

> ... the important issue of the stationary state will be distribution, not production. The problem of relative shares can no longer be avoided by appeals to growth. The argument that everyone should be happy as long as his absolute share of the wealth increases, regardless of his relative share, will no longer be available. Absolute and relative shares will move together and the division of physical wealth will be a zero sum game.

The desirable aspects of the steady state were realized long ago. John Stuart Mill (3) wrote in 1857:

> It is scarcely necessary to remark that a stationary condition of capital and population implies no stationary state of human improvement. There would be as much scope as ever for all kinds of mental culture, and moral and social progress; as much room for improving the Art of Living and much more likelihood of its being improved, when minds cease to be engrossed by the art of getting on. Even the industrial arts might be as earnestly and as successfully cultivated, with this sole difference, that instead of serving no purpose but the increase of wealth, industrial improvements would produce their legitimate effect, that of abridging labour.

This, then, is the state of equilibrium, which seems to be the logical consequence of the adoption of the long-term objective function.

The changes needed during the transition from growth to equilibrium are tremendous, and the time is very short. But the results seem worth striving for, and the first step - the acceptance of a long-term objective function - is one in which the churches have always been a leader.

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(2) H.E. Daly, "Towards a Stationary-State Economy", forthcoming in The Patient Earth, John Hartre and Robert Sorolow, eds., Holt, Rinehart and Winston, 1971.

(3) J.S. Mill, Principles of Political Economy, Vol. II, London: John W. Parker and Son, 1857.

Comment by Dr. Denys L. Munby, Nuffield College, Oxford, U.K.:

This paper follows very much, especially at the end, the theories of the classical economists which had a great vogue for many years; and essentially the model has the same features which led John Stuart Mill to say, not that the stationary state was something we ought to move to, but that the stationary state was something we would inevitably come to. This was because land was limited and, while capital could grow, the return to capital diminished over time, and therefore you would be bound to have the stationary state. This is the kind of economics on which Marx also relied. The same kind of theory is found deeply imbedded in many economists' view and was put by Keynes, in the late 20's, in The End of Laissez-Faire. Some American Keynesians, particularly the distinguished Harvard economist Alvin Hansen, took the matter up after the great depression and thought we had already arrived at the stationary state or were convinced that America was soon going to be in it.

John Stuart Mill and the classical economists certainly would not have thought that we would have been in a rapid state of growth at this stage in economic history. The basic fact is that the other tendencies have been offset by technical progress. Now Dr. Randers, whose paper I very much enjoyed, admits that technology was the sort of bug-bear he had to attack, but I don't think he quite adequately dealt with the possibilities of technical progress. This was the thing that was neglected in the classical economic model. And let me illustrate the way in which this would come out.

Some of you may have noticed in the agriculture curve that up to the present time there were just so many hectares per man to provide the food supply. In the future there were two possibilities for increasing productivity, and it was said that doubling it would put the problem off for a bit. We were not given the technical progress function in agriculture, namely the rate of growth of productivity per acre in the past, which I think has been, in some countries at any rate, rather high. The difficulty is that the data on which the argument is based are not in the paper. I don't know what they are and one may be skeptical of the figures apparently used. I did notice another thing which I think is rather significant. In the graph the natural resources curve from 1900 to 1970 (the total natural resources available to the world) has fallen by 14% between 1900 and today. In my definition of natural resources it would be the natural resources available to man in the sense that they are known about and are usable; and I would have thought that it was just not true that they had fallen. I would have thought that a common sense view of natural resources is that they had increased. We have atomic energy we did not have, and we have discovered many new sources of well-known natural resources (e.g. coal). If it is argued that the curve relates, not to resources known at any given time, but to the absolute quantity (e.g. of oil and coal) available on the globe, then I don't know how we measure what we don't know about, and how we can say that there has been a 14% fall since 1900. (There are also possibilities of substitution and better utilisation, which technical progress brings about.) So all this part of the argument depends on the assumptions that there are these limits to natural resources and I am very skeptical about setting any such limits. I must admit that I prefer the kind of approach used by Prof. Boulding in his paper in Anticipation which says some very sensible things about all this.

Then there is the pollution problem. This raises obviously very complicated views on which I am not competent. But we were told that the final thing that is going to hit us was the second law of thermodynamics which was going to heat up the world. Dr. Randers did say at that point that he did not know that this was going to happen. Well, that is rather crucial because if these sort of final barriers depend entirely upon things we don't really know about, how can we know whether it will be the final barrier? I have a very big question-mark here.

Let me now go on to the next point. It is that most economists in making forecasts want to put in some kind of probability factor, to measure the degree of uncertainty. You want to know the ranges; and, though we were given certain ranges, we were not really given much detail on the ranges of some of the critical factors, and the possible rates of growth of some of the resources and so on. This is a very crucial point in this whole field of science and the environment, namely risk. And here I refer back to my paper on the question of cost benefit analysis and all that. Perhaps I could also quote from a book which my daughter lent me and which I was reading last night which many of you may have read already, namely Cancer Ward by Solzhenitsyn. Here is the doctor speaking who has had a difficult time with a tiresome patient, someone who is questioning all her methods. Looking back the doctor recalls some of the cases over the last 20 years that were treated with X-rays; now they are discovering that there is a thing called radiation sickness, and a proportion of these people have been seriously damaged. But they were immediately benefitted. And she says, "Was it possible? Could the question arise of a doctor's right to treat? Once you began to think like that, to doubt every method scientifically accepted today simply because it might be discredited or abandoned in the future, then goodness knows where you'd end up. After all there were cases on record of death from aspirin. A man might take the first aspirin of his life and die of it! By that reasoning it became impossible to treat anyone. By that reasoning all the daily advantages of medicine would have to be sacrificed. It was a universal law: everyone who acts breeds both good and evil. With some it's more good, with others more evil. Reassure herself as she might - she knew that these accidents, combined with cases of mistaken diagnosis and of measures taken too late or erroneously, comprised more than perhaps 2% of her activity, while those she has healed, the young and the old, were now walking ... There were thousands of them, not all of whom had forgotten her or would forget her - and yet she knew that she would sooner forget them all, her best cases, her hardest won victories, but until the day she died she would always remember the handful of poor devils who had fallen under the wheels."

I think that is the human situation, and somehow or other we have, in our analysis and discussion of the future and environment, to take account of that kind of element of risk (or probability factor), in this instance of 2%. We have scientific methods of dealing with that up to a point, but there are other more difficult points. I merely put it to you that that is a very important element in the situation.

The other point which I just might mention is this - just to give a lead on the political and economic side. With all our quantitative analyses we are moving into a world of experts and specialists and technocrats.

Dr. Randers is after all only another kind of technocrat like all of us, or some of us. Many of us will not be able to understand many of the things on which our future depends; and yet in all this there is bound to be a decision-making process involving human beings. One of the interesting things that came out, perhaps indirectly perhaps fairly directly, from yesterday's discussion by the scientists, is that science after all is a social activity. And, just as there can be a sociology of religion, there can be a sociology of science, and even the things that appear to be most technocratic involve at some stage a discussion among human beings, the relationship between human beings, a process in which human beings cooperate with others and come to decisions on certain assumptions and are checked by other groups of human beings. In this technocratic world, however paternalistically, however dictatorially a technocratic world is organized, you are bound to come back to the fact that you are going to be committed to some kind of decision-making process. One of our problems it seems to me that we have to face is to devise, and think about, what are the correct decision-making processes that will both take account of the objective facts and of the human considerations, of the human reactions to objective facts and the desires and needs of ordinary people. In the complex technocratic world in which we live this becomes an even more difficult problem for our traditional social theories.

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Comment by Dr. C.T. Kurien, Madras Christian College, Madras, India:

If we take Dr. Randers' paper too seriously there is little we can do or say, because the whole thing will come to an end in 30 or 50 years. But I shall not take it at that level.

Let me point out two things about the paper that I appreciate and then pass on to some criticisms.

First, I think it is good to remind economists and others that they cannot put complete faith in an unending process of growth, that from a physical point of view at any rate, one has to start thinking in terms of an optimal rate of growth. In the past at least the economists had uncritica accepted the dictum that the higher the rate of growth the better it is. Dr. Randers' paper challenges this view and goes to show that an unlimited rate of growth or even a sustained rate of growth at present levels is not physically feasible. This is one of the most valuable contributions of the paper.

Secondly, by the rigorous use of the techniques of systems analysis Dr. Randers has brought out the network of inter-relationships that link up population growth, capital formation, use of resources, technology, energy, etc. This again I find extremely valuable because normally our optimisms and pessimisms about the state of things to come are based on our observations about our own little corners and systems. The net-work of inter-relationships that has been developed and demonstrated in the paper

gives us a much clearer perspective of the nature of the problems that we are likely to confront in the not too distant future.

But I have very serious reservations about the message that the paper is trying to convey. In presenting the paper Dr. Randers has emphasized over and over again that the study as it stands now is entirely at the physical level. But this is not so. Let me just give one example. Dealing with the population issue Dr. Randers says: "A large portion of the world's parents bear children primarily as a source of support in their old age. If there is a high mortality rate, one must bear three or four to ensure that one will live." Well, if this is the reason for the exponential growth of population, it certainly is not a physical fact. There are other instances of this kind in the paper. In fact, in spite of his desire to confine the analysis to the physical world Dr. Randers finds himself in the social and political worlds from time to time. (See his reference to military expenditures, etc.)

This is inevitable. For, if Dr. Randers is concerned not only about the rates of growth, but also about decisions regarding the rate of growth, he cannot remain merely at the physical level. What Dr. Randers has attempted to do is to make an analysis essentially in physical terms to solve a problem which is only partially a physical one. But how much of economics and economic problems can we really tackle at the physical level? I would draw a distinction between the "earth" which is physical and hence the realm of the physicist, the technician and the engineer, and the "world" which is social and hence is the domain of the politician, the sociologist, and the economist. The "world" consists of the "earth" and the net-work of its physical relationships, but also human motivations, institutions and the net-work of social relationships whereby the physical earth is transformed into the social world. And solutions to the problems of the "world" cannot be achieved by an analysis of the "earth" however thorough that analysis may be.

If this is the case some questions will have to be addressed to Dr. Randers' paper. In the first place, to what extent is growth, economic growth, a physical phenomenon? Economists have been giving some thought to this question - although they find it an awkward question to handle - in recent years. Studies done in the United States in the fifties and the sixties have shown that anywhere between 70 and 90 per cent of the growth of the United States during the last 100 years or so cannot be accounted for in terms of physical resources, land, labour and capital. Economists have attributed all this to "technology". But our "technology" is very different from what Dr. Randers would understand by that term; it is, as at least one honest economist has admitted, simply "a measure of our ignorance", and consists of all that we have not been able to identify and measure, including human ingenuity, educational improvements, social organizations and the like. In his treatment of growth Dr. Randers does not even appear to be aware of what we economists consider to be "technology". And if an economist can for once become an optimist, can we completely rule out the possibility of something from our "technology" emerging to avert the catastrophies that his paper holds out?

But this is not my main question, although, I must confess that I find myself raising this question frequently. The big question I would like to pose is this. Can the problems of the social world be viewed in global terms? After his "global" analysis Dr. Randers comes to some "global" remedies. The clearest of these is relating to Figure 8 which says down "one set of conditions that sstablishes a world equilibrium" and it reads as follows: "In 1971 capital investment rate is reduced 40%, birth rate is reduced 50%, pollution generation is reduced 50%, natural resource usage is reduced 75%, and food production is reduced 20%." I shall overlook the fact that only a physical scientist who does not have to, or would not worry about feasibility could have put forward such a suggestion. But as a social scientist I am forced to ask: "Whose capital investment and food production are we talking about?" For, obviously, there is no such thing as world capital investment and world food production except in a statistical sense, and statistics, for better or for worse, do not make decisions! And if decisions have to be made, an abstract view of the physical world without reference to the way in which human beings are organized into societies and nations is of no help at all.

On the other hand such "global" prescriptions can turn out to be mischievous. It can become a weapon in the hands of those who wield power to suppress or thwart efforts to increase the rate of capital investment, natural resource use and food production where such an increase is absolutely necessary. Or it can mislead benevolent, but simple souls to argue that a sudden and drastic cut in the growth rate of the richer countries is the sure way to sustain growth in the poorer countries overlooking the nature of interdependence the world economic systems now possess. If Dr. Randers is not aware of these problems, I wish he had not gone into the discussions of the Golden Age, the Stationary State and such other romantic concepts.

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Comment by Dr. Charles Elliott, Assistant Secretary, SODEPAX; formerly Reader in Economics, University of Zambia, Lusaka, Zambia:

It seems to me that both Prof. Munby and Dr. Kurien come near to denying the problem exists and that seems to me to be somewhat shortsighted. I think Dr. Randers would agree that he is not predicting a world collapse in any one year or even in any one half century; he is saying that there are a series of questions that have now got to be asked of the system as a whole and that we cannot go on dodging them. It seems to me interesting that Dr. Kurien himself posed some of the questions, in a rather negative fashion that I think Dr. Randers would now want to see the world community as a whole pose. I am less concerned about the methodological inexactitudes of Dr. Randers' model, if such exist, than about taking seriously the questions that I think the bulk of the evidence suggests we must begin to reflect upon.

My second point is not unrelated. I am surprised that Denys Munby did not take up the very considerable disagreement that I detect between him and Dr. Randers about the nature and usefulness, and indeed the theological impact, of cost-benefit-analysis. In his paper Denys Munby seems to me to be over-optimistic about the results of cost-benefit-analysis and indeed I think if he had put the discussion of the Third Airport in London in a wider context, it would have been easy to show just how fallible a tool this is.

But the more fundamental point is that it raises an immensely important theological question about how we deal with time. Dr. Randers is asking us to develop techniques for accepting the fact that a man or a child born in the year 2010 has the same ultimate value as a man living now. The cost-benefit techniques are based on the assumption that things that happen in the future - the things that we usually thought would happen in the future in the income stream - is of less present value the further ahead it is in the future.

There is here a fundamental disagreement which I would very much hope the Working Committee will spend considerable time on. It crops up again and again. It crops up in the whole discussion about population. It crops up in the discussion about development at large, and the sooner, I think, we try to develop a way of looking - theologically, if you like, but realistically certainly - at time and the way we deal with the future events and the way we discuss them, the better.

A third point. I agree, I think, with Dr. Kurien that to cast the whole thing (and I have every sympathy with Dr. Randers in trying to present briefly the results of five years work) in terms of physical data is somewhat inadequate. I have seen that inadequacy within my own small programme on Poverty 2000. One adaptation which we are now making to the model there described is to look at its predictive value for social conflict. Can we use the sort of model that we are trying to develop to predict such disequilibria - between groups and within groups, between societies and within societies - so that the probability of some sort of conflict is discontinuous upwards, so that you rise from a 10% probability to a 50% probability at some level of disequilibrium? Some work is being done, particularly by the Japanese on this. But I think it ties in because at one point in his paper Dr. Randers talks about the end time being marked by a social conflict. But it is not necessarily the physical things that stop the system, it may be a social breakdown. Now I think one can develop his approach and our approach in the poor countries closer at some point in such a way that you can show that the system has within it, or is likely to develop within it, such disequilibria that conflict develops and that this may be a sign of breakdown or blow-up or what have you.

My last point - and very difficult one, one that I have not thought out myself - that is, the dangers of modelism. I think every model-builder is aware of the dangers that he courts in trying to describe reality in a model; and you know that there is a great deal written and thought about this. When one gets to this level of abstraction one has to go on asking questions. I am somewhat perturbed that Dr. Randers said the only value judgement in the model was the quality of life index. That I do not accept. It seems to me that any model is based on a whole series of judgements which certainly have a normative component. They may not be entirely normative. The methodology itself comprises a normative judgement or a whole set of judgements and the assumptions implied by the methodology also imply a normative judgement. Now this seems to me to relate back to the whole political-social dimension that Dr. Kurien was trying to introduce. There is a theological dimension that de Rosen was hinting at in his intervention earlier in the day - how can one subject this type of model to continuous criticism and opening up by non-model builders so that one is a least made continuously aware of the normative judgements that keep slipping in through the back door?

I think this is something which every model-builder wrestles with; again it is something which the Working Party - if they are going to get involved in this kind of exercise - whould take very seriously. Because unless you do take it seriously you will end up with a bogus discussion of a very bogus reality.

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Comment by Prof. S.L. Parmar, University of Allahabad, Allahabad, India:

The early sixties were characterized by an optimistic view of technological possibilities. It was assumed that the contemporary technological revolution will continue to open new vistas of prosperity and material betterment and in the process poverty and misery would somehow be eradicted from the face of the earth. In its economic connotation such optimism led to an emphasis on increasing aggregate production, maintaining a high rate of growth and promoting the transfer of capital, technique and entrepreneurship from developed to developing countries through an extended scheme of foreign assistance. The logic of potential abundance made rapid growth the new economic gospel. Implicit in the approach was the assumption that if adequate quantum of resources are applied to any situation of underdevelopment, that will accelerate aggregate output and somehow solve problems of distribution - encapsulated in the omnibus phrase "social justice". This is one of the major undergirdings of the "production first then distribution" or "development is economic growth" approaches.

Experience of the sixties clearly negates such optimism and automaticity of growth as an instrument of social justice. In many cases a high rate of growth not only made existing structures more rigid but increased their power; with the result that these became more serious obstacles to social justice. Consequently a shift has taken place in socio-economic thinking which emphasizes that unless structural changes precede and create new power relationships all efforts to promote and maintain a high rate of growth will be nullified. Without a visible advance of social justice a society will be plagued by conflict conditions and social dislocation which will inevitably weaken the growth process. However, such a view continues to be seriously challenged by the 'growth' enthusiasts among social scientists. Let the debate continue.

Towards the end of the sixties a more sombre, one may even say "pessimistic" approach to technological possibilities has emerged. In the 1971 meeting of the Working Committee on Church and Society a young European scientist, now at M.I.T. in the USA, Dr. Randers, played the scientific Jeremiah by stressing that material resources are finite and non-renewable and modern technology in its pursuit of higher production is using up these scarce resources at an alarming rate. If present trends continue we will soon exhaust resources and hence the potentialities of technology. Such a view challenges the"potential abundance" approach to technology. It would be premature to opt for one or the other approach, but the fact remains that the dialectic between the two must be maintained as we consider the future of man and society.

I would like to submit that two significant issues emerge from the debate about limits of technology. Both are of special importance to developing nations and underprivileged groups in developed nations.

First, a recognition of the limits of technological power will aggravate conditions of conflict in society. The 'haves' recognizing that their power will not be replenished are likely to harden their attitude in sharing the political, economic and technological power they now control. A more defensive status quo cannot but become more belligerent. On the other hand the "have nots" deprived of the hope that technology will someday bring abundance, are likely to press for social justice NOW. In other words the "pessimistic" approach to technology reduces the time horizon of social expectations. Our view of the near future should recognize these impending thunderclouds of social conflict.

Second, developing countries can no longer nourish the illusion of "catching-up" with the developed. Even under an "optimistic" view of the technological revolution such hope had dimmed by the experience of the sixties. Now the "pessimistic" view clearly points to a tapering down and a possible stagnation of the growth process. Realism (which in fact, is a responsible recognition of realities of the power relationships between rich and poor nations) requires that we of the Third World give up the western concept of development and discover our own concept. If it is not possible both because of the international power relationships and the limits of technology to maintain high rates of growth, if the current understanding of development dooms us to perpetual poverty, we must recognize that such development is not for us. How then should we understand development? The economic approach which gives precedence to social justice over growth is an outcome of the experience of developing nations. In that sense it is a different understanding of development arising out of our societal realities. But, by and large, our pre-suppositions and frame of thinking continue to reflect the experience of developed nations (both liberal and Marxist). It is time that we struggled for a more relevant conceptual frame in a systematic manner, marked by a sense of urgency. Our economic models must be indigenous; our economic thought liberated from its western moorings. The quest for authenticity in social theory and practice is an imperative for the Third World as it looks at the future of man and society.

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II

THE PROBLEMS OF URBANISATION IN LATIN AMERICA: A FUTURE PERSPECTIVE *

by

Jorge E. Hardoy

Let me try to summarise the prospects for urbanisation in Latin America for the years immediately ahead.

Theoretically cities can grow indefinitely. A country's population might become 100% urban and still cities will continue growing in absolute numbers. This is one of the fascinating aspects of Latin America where, country by country, you find the whole spectrum of situations from Argentina and Uruguay which are more than 80% urban to Haiti which is less than 20% urban.

With very few exceptions most governments in Latin America have a laissez-faire attitude towards problems of urbanisation. With only one or two exceptions no national development plan for Latin America includes provision for a process of urbanisation, nor for urban policies, nor for tackling problems of the future of the human environment. My country, Argentina, is a good example. Just two weeks ago the present régime decided to adopt a national development plan. It is a relatively well done analysis of different sectors of the economy but does not include a single sentence about the problems of urbanisation in a country that is 81% urban and where urban population grows at more than 100% a year (in other words, rural population is declining in absolute numbers). There is not one sentence saying how to deal with a problem which is overwhelmingly the problem of our society.

I. Demography and Urbanisation

Two main reasons explain the rapid process of urbanisation that is taking place in Latin America: (a) the high rate of natural increase of the population due to a sharp decline in the death rates, especially since the 1920's and the 1930's, and continuous high birth rates in most countries of the area;

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* In the preparation of these notes I have used freely information I included in the following papers: (a) "The Welfare Economies and Diseconomies of Scale", a paper read at the Workshop "A Widened Perspective of Modernising Agriculture" Cornell University, Ithaca (New York), June 2-4, 1971; (b) "Policy and Planning Related to Rapid Urbanisation", a paper prepared for the Rehovot Conference on Urbanisation and Development in Developing Countries, Israel, August 16-21, 197

(b) the migrations from rural areas to urban areas. Two other factors also contribute to the growth of urban population: (a) the migrations from countries outside Latin America, which were important in the formation of the demographic structure of Argentina, Uruguay, Cuba and Brazil before World War I and of Venezuela after World War II, and to a lesser degree of Chile and other countries, have lost importance; (b) the international migration between bordering Latin American countries, especially towards Argentina and Venezuela.

In 1970 the total population of Latin America was estimated at 283,250,000 inhabitants. The annual rate of increase was 2.87%. The urban population was estimated at 159,188,000 inhabitants and represented in 1970 56.20% of the total population. Urban population was growing at an annual rate of 4.34% while rural population was growing at an annual rate of 1.15%. By 1985 the total population is expected to number 430,640,000 inhabitants. 66.88% or 290,680,000 will be urban. In other words, between 1970 and 1985 the increase of urban population will be 131,492,000 new urban dwellers, an average of 8,766,000 per year. Rural areas will have to absorb 19,898,000 inhabitants, an average of 1,326,500 inhabitants per year.

Population and especially urban population has a tendency to concentrate in relatively small areas of each national territory, reflecting the disequilibrium in the levels of development and the uneven distribution of opportunities and resources that exist in each country. This is a consequence of the persistence of the historical tendency to concentrate key functions and population in some few key areas leaving immense periphereal areas subjected to them.

II. The Problem of Urban Stability

Urban stability, or potential for urbanisation, differs from country to country. The method of measuring urban stability is based on the comparative use of three static indicators for each country. The percentage of rural population, the annual rate of growth of the total population and the annual rate of growth of the rural population in 1970 - and one dynamic factor: the expected decrease or increase in the annual rate of growth of the total population by 1985. The countries of the area can be classified as urbanistically stable (Argentina, Uruguay and Trinidad), urbanistically moderately stable (Chile, Cuba, Jamaica and Venezuela), urbanistically unstable (Brazil, Colombia, Mexico and Peru) and urbanistically very unstable (Bolivia, Panama, Ecuador, Guatemala, Nicaragua, Dominican Republic, Paraguay, Haiti, El Salvador, Costa Rica and Honduras). There is a correlation between the urban stability or potential for urbanisation and the level of development of Latin American countries as expressed in social and economic indicators. The more stable are, as a rule, the countries with the highest income per capita, the highest percentage of literate population, the highest percentage of the population registered in universities, the highest percentage of the population economically

active in the secondary sector, etc. And, of course, the most urbanised in 1970.

The countries with the highest potential for urbanisation have a small total population. But the four countries considered as urbanistically unstable (Brazil, Mexico, Colombia and Peru) will have to absorb 69.7% of the expected growth of total population of Latin America between 1970 and 1985 and 72.9% of the expected urban growth. In 1970 their total population was 62.8% of Latin America's. Brazil alone will have to absorb an average of 3,300,000 new urban dwellers per annum during the next fifteen years, Mexico 1,852,000, Colombia 909,000 and Peru 393,000. Other countries with important numbers of new urban dwellers are Venezuela, which will have to absorb 443,000 per annum, and Argentina with 432,000. On the other hand, Trinidad will have to absorb only 23,000, Jamaica 37,000, Uruguay 46,000 and Panama and Costa Rica 45,000 each.

Unemployment in the rural as well as in the urban areas is high. The exodus to urban areas has become the alternative for rural people throughout Latin America to high rates of rural unemployment, seasonal employment, poor educational and health services and a life without attractions. Figures about underemployment are hard to find. Together, unemployed and underemployed form a large share of the population of working age. Migrations to urban areas have transferred a rural problem to an urban situation as the urban industrial sector has not been able to absorb the increasing demands for employment. All over the industrial areas of Latin America relatively good to fair rates of growth of industrial output have resulted in very low rates of industrial employment growth. The burden of absorbing the annual increase of the new urban population has been left, to a large degree, to the service sector, which is already over-expanded in relation to the real demands or the capacity of each country to create more jobs in this sector.

Rapid urbanisation has also resulted in tremendous pressures on urban services, community equipment and housing. The housing deficit increases annually. No country in the area produces enough housing to supply the demands of the natural increase of population. Much less can they solve a housing deficit estimated at over 30 million units (rural and urban) in 1970 or establish a basic programme of annual replacements.

The costs of providing the new urban population with minimum housing and services are so enormous that drastic solutions should be attempted. An optimistic estimate of the cost of a housing unit with services (water, electricity, pavements and sewers) and its share in the cost of a health centre and elementary school, plus the land and a low overhead of 30% (interest taxes, earnings of the building enterprise, etc.) will be around US $1,500 per capita. Costs, of course, differ from country to country. This means an annual investment of 13.1 billion dollars to house 8,766,000 new urban dwellers per year. Such a sum would represent more than 50% of the net

investments that take place in Latin America every year. And still we would have created only the jobs related to the building industry in a situation in which the main task for Latin America is to create new urban as well as rural jobs, in the extractive as well as in the industrial activities and services. And we would have left aside some of the key areas for the development of a country.

The situation explained above clearly demonstrates that in Latin America urban economies have not been able to provide employment and basic services to a large percentage of the urban population. The future is not at all promising,

The natural growth of urban population, without taking rural migrations into consideration, is sufficiently high as to absorb alone all new sources of urban employment. Far from declining, the natural growth of urban population will possibly be higher during the next decade and we have to expect a larger discrepancy between the growth of population and the growth of employment. Urban and rural problems are so closely interconnected that it is hard to believe that they still are tackled as separate entities. However, this is the reality of Latin America with few exceptions. Councils in charge of defining policies, ministries in charge of executing programmes, research teams, power groups, etc., have a tendency to separate urban and rural problems. The result is poor knowledge of the overall situation and poorly coordinated programmes.

Costs of urbanisation are high for a variety of reasons. Among them:

(a) the low densities which influence the costs of supply and maintenance of urban services;

(b) the fragmentation of urban and suburban land which makes difficult the construction of large residential units and an adequate coordination of land uses;

(c) the unadequate technology employed by the building industry which still is based in handicraft procedures with some standardised parts;

(d) the polarisation of building procedures, from the design of a project to the supply of building materials;

(e) the speculation with urban and suburban land.

III. Lack of Technology

The technology employed in the construction of cities has not made great improvements. In developing nations self-help methods are responsible for the construction of substantial parts of urban areas. Without relying on capital intensive technologies, given the unemployment situation, I believe that it is possible to develop building methods that could make an adequate use of

human resources and materials available in each region while gradually improving standards and the efficiency of the whole building industry.

Urban areas are not prepared to deal with the fast demographic and physical growth that is taking place and that is expected. Perhaps we are adopting unrealistic standards as to housing and urban construction. However, I am convinced that unless we slow down urban growth - in other words, unless we develop means of absorbing part of the rural population and of decentralisin the urban areas will be increasingly unable to provide employment, housing, services and basic amenities.

We have tackled development problems as if they were a dichotomy between what is urban and what is rural. We have accepted development plans as economic exercises with neither a human context nor popular support. We are witnessing the growth of technocracy and the increasing impact of technocrats willing to serve practically any political system.

We have forgotten how subtle and difficult it is to motivate the people, how much foresight and leadership and honesty has to be invested in the formation of nations.

Many nations of Latin America have not yet witnessed the peak of their process of urbanisation. For those nations the study of settlement patterns is essential because once they are defined, in a planned or in a spontaneous way, they will be difficult to change. It is true that we have poor information systems to increase our knowledge of urban areas but still we can predict what will eventually happen to the urban areas with some accuracy. It is also true that real changes are taking place in the social and political structures of Latin America.

We come then to a key question: which political system is the most convenient for countries in the phase of development of Latin America? Different socio-political systems have developed or can develop different urban systems, which have reflected or will reflect different development objectives. Urban systems in which these find expression will serve a nation or a region better or worse depending on the independence that governments have to utilise the factors that determine the functions of the elements of such systems.

IV. Prospects and Needs

We have observed that there are no policies on the part of governments, no serious efforts to organise this process of urbanisation; and that perhaps by the year 2000 we will have an urban conglomeration of more than 40 million people between Rio de Janeiro and Sao Paulo, one of around 30 million people in Mexico City, one of about 20 million which is the industrial conglomeration around Buenos Aires, and several others of 10 million people. The question

therefore is: if we have not learned how to live in cities of one million, or two million or five million, how will we solve the problems of living, building and running cities of 40 million? What sort of cities will they be? All my life has been dedicated to research on these urban problems and now I am quite lost. By nature I am an optimist, but I am quite critical of most of the literature which is appearing in the developing countries about taming megalopolis, the metropolitan crisis, the unheavenly cities and such titles. These books sell well but generally fail to deal directly with the problems of urbanisation as such. A city is not an obstruction; a city is a man-made artificial environment that performs certain functions. There is something wrong with the cities because there is something wrong with the society which is building the cities and the people who live in those cities.

So what can be done? We have to be realistic. Under the present power structures that exist in Latin America and given the present approach to the problems of urbanisation I see absolutely no solution. This is the first conclusion I have reached. Yet there is much room for improvement and to take advantage of this we must adopt measures that will prevent as much as possible the deterioration of the urban situation and create the preconditions for a more comprehensive solution in the future. Now, this might sound very vague, but let me try to spell it out.

V. Preconditions for Urban Betterment

The precondition is simple. It is closely related to the concept that the land where the future expansion of cities will take place should be declared a public domain. I see absolutely no solution under the speculative process which is taking place and which is physically guiding the growth of urban agglomerations in Latin America.

Land is important for different reasons. If you really want coordinated land use, if you want to create a building industry which can make an effective use of material land resources at your disposal, and if you want to make best use of whatever investments of capital you have at your disposal, this cannot be done with the polarisation of urban and suburban land, the fragmentation of urban and suburban land and the patch-type growth we are witnessing now in most of our countries.

To prevent deterioration we must have socialisation of land for future urban and suburban development, and then an effective use of the resources that are available. This is an important line of research. We just don't know how much is being invested in a city. We know that there are a lot of things being invested in the city by the public sector and the private sector. The public sector includes the national level, the provincial level, the municipal level and autonomous cooperation.

They generally work in a very uncoordinated way; quite often you have jobs in areas without housing and housing in areas that require an hour and a half transportation to go to the jobs. And frequently you find pavements and no water or sewers; and then these pavements have to be destroyed in order to incorporate water and sewers. In other words, better coordination and better knowledge of how much is being invested would help us to develop more adequate policies of investment in the urban and suburban areas. Moreover, we just don't know which are the decisions which affect the social structure of a nation as a whole and the internal structures of cities and towns. Most of our settlement patterns reflect the type of economic development which depends largely on foreign pressure for the export of certain commodities and the import of certain consumer goods. In other words, a fan-shaped settlement pattern like the one that exists now in Uruguay and Argentina reflects the overwhelming role of Great Britain in certain periods of overdevelopment and the role of the cities of Buenos Aires and Montevideo as "funnels" for this export/import activity.

This settlement pattern does not serve adequately the real needs of Latin America. Cuba is the only example in the region where a consistent policy of decentralising productive investment and services has managed to control the growth of a major capital city. The national average population growth of Cuba is 2.1%. Havana has been growing consistently during the last four or five years at 0.6%, while other alternative cities like Holguin are growing consistently at about 5%. This has been done without enough research, with too few trained people, yet with coherence and enthusiasm.

VI. Two Additional Concepts

More and more in the next few years we will hear talk in Latin America about urban reform. When I lectured last year in the USA on this subject, most of my audiences confused urban reform with urban renewal. Tragically, "urban renewal" in the USA has largely been a re-speculation of land that has been subjected to speculation for generations. Urban reform goes far beyond simple changes in urban and suburban land tenure systems and urban land uses. It is a much more radical and comprehensive concept involving new forms of urban government, public investment and mass participation. It envisages changes in the power structures that control the dynamics of urban growth and the internal structures of the cities. This concept of urban reform is essential.

Inevitably there will be urban reforms in the next ten and twenty years in Latin America. An attempt was made in the early '50's in Bolivia. Cuba has by no means solved all its urban environment problems, but it has created the precondition for a better solution when the resources are available to invest in the creation of better cities. This line of thought on urban reform is important in order that we do not repeat the same mistakes that we made 30, 40 and 50 years ago in agrarian reform. Most of the agrarian reforms in

Latin America are of the normative or indirect type and not of the structural or direct type: you have agrarian reform in Nicaragua and many Central American countries, for example, which is simply a mockery.

Let me finish by making one specific recommendation to this Church and Society Working Committee. Definitely we don't know much about the process of urbanisation in Latin America - but I think we know enough country by country. Definitely we don't have enough experts in this field - but it is not because of a lack of knowledge or a lack of people that we are not doing the things we should be doing. The question is rather: how can we further the conscientisation of the people so that they can start acting politically and exerting the necessary pressure? After discussing this with colleagues throughout Latin America I came to the conclusion that more research, essential as it is, is not a priority need; training, essential as it may be, is not a priority. What is vitally necessary is to find ways of exposing that knowledge and distributing it - not to the scientist, not to the technician, who is more or less aware of it already - but to the people: to the groups of people that have the potentiality of exerting pressure for the changes that are necessary if we are to overcome these problems of urbanisation.

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